The rapid on-line diffusion of short messages, or "memes," can be mathematically treated as an epidemic spreading pro
Introduction The spread of information in on-line social systems bears striking resemblance to pathogen transmission in
Classic well-mixed models offer a parsimonious answer: inoculating a fraction $1 - 1/R_0$ of individuals collapses the basi
In this study we revisit the archetypal configuration model under the simplifying assumptions of (i) negligible degree–d

Random vaccination—each node is independently immunized with probability p.

Fixed-degree vaccination—all nodes of degree exactly $k = 10$ are vaccinated.

The remainder of the paper is organized as follows. Section details the analytical framework, network construction, pa

Methodology Analytical vaccination threshold on uncorrelated networks For configuration networks without degree cor

When immunization is *not* random but concentrated on a specific degree k, the algebra changes. Let P_k be the pre-vac
$\langle k^2\rangle' = \frac{\langle k^2\rangle-(k)^2 f}{1-f}$. Plugging these into q' yields

Because f is typically tiny for moderate k in thin-tailed networks, q' often remains above unity even after full removal of th

Selecting a representative degree distribution To validate the analytics in silico we require a concrete network whose me

so vaccinating all $k = 10$ nodes removes only 0.81% of the population.

Network synthesis Using the `networkx` configuration-model generator, we sampled $N = 10^4$ degrees from the selected n
$q = 3.9623 \qquad (\approx 4)$. The adjacency matrix was stored as a CSR matrix (`network.npz`) for simulation reproducibility.

Disease dynamics and parameters The meme dynamics were modeled as a continuous-time SIR process with infection r
Vaccination scenarios and initialization **Scenario 1 – Random vaccination.** Each node was independently assigned
Scenario 2 – Fixed-degree vaccination. All nodes of degree exactly 10 were pre-assigned to R. This immunized fra
Simulation engine We employed `fastGEMF` v2.1, which implements the generalized epidemic mean-field framework via t
Results Analytical predictions Equation eq:rand$_t$*hresholdprescribes*p$_c$ $= 0.75$ for random immunization. For fixed-degr

Stochastic simulations validate analytics *Scenario 1 (random 75% vaccination). The epidemic never gained traction (F
*Scenario 2 (all $k = 10$ vaccinated). Figure shows a dramatic outbreak: prevalence climbed to 15.9% around $t = 23$ an
[http] [width=0.9]results-11.png Temporal evolution of compartments under 75% random vaccination. The infectious cu
[http] [width=0.9]results-12.png Temporal evolution under universal degree-10 vaccination. A large-scale outbreak occu
Discussion The combined analytical–computational investigation yields three principal insights.
Random versus targeted immunization efficiency Random vaccination achieves herd immunity exactly at the classical b
Implications for social-media content moderation Online platforms often rely on flagging or throttling a handful of larg
Limitations and future work We assumed sterilizing immunity, static contact structure, and no degree–degree correlatio
Conclusion We analytically derived and numerically validated vaccination thresholds to halt meme propagation on an u
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M. Zhou, W. M. Xiong, H. Liao, *et al.*, "Analytical connection between thresholds and immunization strategies of SIS mode
J. B. Jia, W. Shi, P. Yang, *et al.*, "Immunization strategies in directed networks," *Math. Biosci. Eng.*, vol. 17, no. 4, pp. 39

Reproducibility material All Python scripts, networks, and CSV outputs are included in the accompanying `output` dire